

A5
Could.

contributions by the individual radiating elements to a composite array signal due to the separation of the elements along the axis are equalized by the true-time-delay network. B

A6

15. (Amended) The antenna of Claim 14 wherein each flared notch radiating element includes a pair of flared dipole wings. B

Add the following new claims.

Sub. 03
A7

20. (New) A conformal end-fire antenna, comprising:
a high impedance ground surface structure, comprising an array of metal protrusions on a metal sheet, the metal protrusions arranged in a two-dimensional lattice;
an array of wide band flared notch radiating elements positioned adjacent the ground surface structure, said array of radiating elements comprising a plurality of radiating elements arranged end-to-end along a common end-fire axis and spaced apart along the axis by a separation distance. B

REMARKS

The Examiner is thanked for the careful review of the application as set out in the outstanding office action. Reconsideration of the application is respectfully requested.

A marked up version showing the changes made to the application is attached hereto.

Claims 1 and 6 have been cancelled, and new Claim 20 has been added. The dependencies of Claims 2-4, 7 and 9 have been amended to depend from new Claim 20.

Objection to the Drawings

In response to the objection to the drawings, a red-lined copy of FIGS. 1 and 2 is filed herewith in a separate letter, requesting approval to include the legend "prior art." As for FIG. 3, the objection is respectfully traversed. FIG. 3 discloses an antenna in accordance with applicants' invention, and is not prior art. See applicants' specification at 6:14-32.

Claims Rejections - 35 USC § 112, 2nd ¶

Claims 6-10, 13 and 15-16 stand rejected as being indefinite. The rejection of Claim 6 is mooted by its cancellation. Claims 7, 9, 13 and 15 have been amended to address the matters noted by the Examiner.

Withdrawal of the rejection under Section 112 is respectfully requested.

Claims Rejections - 35 USC § 103

Claims 1-19 stand rejected as being unpatentable over Sievenpiper et al. In view of Lee et al. The rejection is respectfully traversed, on the ground that a prima facie case of obviousness has not been established, and the applied references do not teach or suggest the claimed invention.

While Sievenpiper et al. describes a high impedance electromagnetic surface, and while Lee et al. discloses an end-fire array, the references, alone or in combination, do not fairly teach or suggest the claimed invention.

The Examiner alleges that one of ordinary skill would have recognized the benefit of various alterations and modifications in order to provide a wideband end-fire array of radiating elements, including a plurality of planar radiating elements arranged end-to-end along a common end-fire axis, each element comprising a flared notch radiating element. The Examiner further asserts that the array further includes a true-time-delay corporate feed network connected to the radiating elements (referring to column 1, lines 37-43), and that it would have been obvious to provide Sievenpiper et al. with an array of wide band flared notch radiating elements; an end-fire antenna for mounting on a nose cone of an aerial vehicle; a beam-forming network connected to the radiating elements; a plurality of radiating elements arranged end-to-end along a common end-fire axis; and the beam-forming network including a true-time-delay network as taught by Lee et al. Applicants respectfully disagree. There is no teaching or suggestion to modify the references in the manner set out by the Examiner.

The Federal Circuit stated the law of obviousness in In re Kotzab, 55 USPQ 2d 1313, 1316-1317 (Fed.Cir. 2000):

"A critical step in analyzing the patentability of claims pursuant to section 103(a) is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field... Close adherence to this methodology is especially important in cases

where the very ease with which the invention can be understood may prompt one 'to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher,"... [citations omitted]

Most if not all inventions arise from a combination of old elements... Thus, every element of a claimed invention may often be found in the prior art... However, identification in the prior art of each individual part claimed is insufficient to defeat patentability of the whole claimed invention... Rather, to establish obviousness based on a combination of the elements disclosed in the prior art, there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant... Even when obviousness is based on a single prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference...." [citations omitted]

Here, the Examiner has provided no evidence of a suggestion to modify or combine. The broad allegation that a person of ordinary skill would have recognized the benefit of "various alterations and modifications" is insufficient to meet the Examiner's burden of establishing, by evidence, the suggestion or motivation to combine or modify. Evidence of a suggestion, teaching or motivation may flow from the prior art references themselves, the knowledge of one of ordinary skill in the art, or in some cases, from the nature of the problem to be solved. The range of sources available, however, does not diminish the requirement for actual evidence. The showing of such actual evidence must be clear and particular. Broad conclusory statements regarding the teaching of multiple references, standing alone, are not evidence. The required showing of evidence should include particular factual findings. In re Dembiczak, 50 USPQ 2d 1614, 1617 (Fed.Cir. 1999).

In fact, the claimed invention would not have been obvious to one of ordinary skill in the art. Sievenpiper et al. do not suggest what would happen if one were to place an end-fire array above a high impedance electromagnetic surface as described in this paper, nor for that matter what would happen if an end-fire array were placed above a conventional ground plane. In the latter case, a beam produced by the array would be deflected away from the end-fire and toward the sky. The fact that Lee et al. discloses an end-fire array with a

true-time-delay feed network does not provide a teaching or suggestion to modify Sievenpiper with these elements. There is no recognition in either reference of any advantage to modify Seivenpiper et al. with an end-fire array, nor that an array of radiating elements when placed adjacent a high-impedance surface as in Seivenpiper et al. would produce an end-fire beam, let alone whether such a modification would produce a working end-fire array.

Applicants respectfully submit that the combination of references is the product of improper hindsight reconstruction, and the rejection should be withdrawn.

CONCLUSION

The outstanding objections and rejections have been addressed, and the application is in condition for allowance. Such favorable reconsideration is solicited.

Respectfully submitted,



Dated: 3-19-02, 2002

Leonard A. Alkov
Registration No. 30,021

Raytheon Company
Building - E1 M.S. 150
P.O. Box 902
El Segundo, CA 90245-0902
Telephone (310) 647-2577
Facsimile (310) 647-2616



VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

The paragraph at page 1, at indicated lines 8-24, has been amended as follows:

For certain applications, a flush-mounted end-fire antenna is required for an airborne or shipboard platform. For example, to combat low flying cruise missiles, a cylindrical UHF electronically scanned array is one of the most effective ways to detect, track, and classify these small targets with enough range to deploy necessary defenses. U.S. Patent [5,874,195] 5,874,915, the entire contents of which are incorporated herein by this reference, describes a robust antenna, which in an exemplary form is conformal to an E-2C radome with an oval cross section. In this exemplary form, the antenna is a non-rotating cylindrical wide band array controlled by a commutation switch matrix to provide 360 degree scan coverage, and includes two decks of radial columns of end-fire elements, with 48 columns on each deck. At any instant of time, for the exemplary antenna illustrated, only one third of the columns, a 120-degree sector, are excited to form a beam.

IN THE CLAIMS:

2. (Amended) The antenna of Claim [1] 20, wherein the ground surface structure is a magnetic conductor surface at an RF frequency band of interest, said ground plane structure functioning as a D.C. short and as a mirror which reflects an RF field in said frequency band with virtually no phase reversal.

3. (Amended) The antenna of Claim [1] 20, wherein the protrusions form a very thin layer of a densely packed two-dimensional (2-D) periodic structure on top of a conducting surface, the periodic structure shielding the conducting surface underneath from inducing an image current to cancel the propagating E-field.

4. (Amended) The antenna of Claim [1] 20, wherein the array of metal protrusions are formed as metal plates connected to the metal sheets by vertical posts.

7. (Amended) The antenna of Claim [6] 20 wherein the array further includes a true-time-delay corporate feed network connected to the radiating elements, wherein time delay differences in contributions by the individual radiating elements to a composite array signal due to the separation of the elements along the axis are equalized by the true-time delay corporate feed network.

9. (Amended) The array of Claim [6] 20 wherein [the] each flared notch radiating element includes a pair of flared dipole wings.

13. (Amended) The antenna of Claim 12, wherein the beam-forming network includes a true-time-delay network, wherein time delay differences in contributions by the individual radiating elements to a composite array signal due to the separation of the elements along the axis are equalized by the [corporate feed] true-time-delay network.

15. (Amended) The antenna of Claim 14 wherein [the] each flared notch radiating element includes a pair of flared dipole wings.